character they are false. Lies are virtuous, the mother teaches her children falsehood. The Hovas have an hereditary nobility, a middle class of workmen and traders, and a slave class.

Herr Von Maechow states that the heights that border the valley of the Kuango reach a height of eight hundred to a thousand feet, while the stream in some places is eight hundred to a thousand feet wide, in others reaches eighteen hundred paces. Everywhere were magnificent forests, and hippopotami were abundant.

News from Mr. Stanley, dating to the middle of December, states that he has started for Vivi, the first of seven stations established by the International African Society. At Vivi preparations are making for the construction of a railway line to the landing place on the river. Bolobo, the last station established, is seven hundred miles from the mouth of the Congo. The seven stations already seem to have become centres of civilization, and are making their influence felt upon the surrounding tribes. Cattle have been introduced at Vivi, cabbage and lettuce are thriving at Leopoldsville, and three small steamers are launched. Fears are entertained lest through the claims of the Portuguese government obstructions to the freedom of way and commerce may arise.

Several Swedish officers have recently left Europe to join Mr. Stanley.

GEOLOGY AND PALÆONTOLOGY.

THE STRUCTURE AND APPEARANCE OF A LARAMIE DINOSAURIAN. —During the expedition of 1882 Messrs. Wortman and Hill discovered in the Laramie formation of Dakota, the nearly entire skeleton of a gigantic herbivorous land-saurian. On investigation it proves to be the *Diclonius mirabilis* of Leidy. The genus Diclonius Cope, is one of the Hadrosauridæ, and differs from Hadrosaurus in the coössification of the astragalo-calcaneum with the tibia. The Hadrosauridæ present the characters of the suborder Orthopoda (Stegosauria and Ornithopoda Marsh). I give an account of the osteology of the skull, together with some systematic conclusions, in the Proceedings of the Philadelphia Academy for 1883, p. 97. The present notice recites a few of the points of that article.

According to Mr. Wortman the total length of the skeleton is thirty-eight feet. The skull measures 1.180 meters. The general form and appearance of the skull, as seen in profile, is a good deal like that of a goose. From above it has more the form of a rather short-billed spoonbill (Platalea). For a reptile the head is unusually elevated posteriorly, and remarkably contracted at the anterior part of the maxillaries. The flat, transverse expansion of the premaxillaries is absolutely unique. The posterior edges

of the occipital bones are produced far backwards, forming a thin roof over the anterior part of the vertebral column.

The orbit is posterior in position, and is a horizontal oblong in form. The superior (superciliary) border is flat, with slight rugosities at the positions of the pre- and postfrontal sutures. The frontal region is a little concave, and there is a convexity of the superior face of the prefrontal bone in front of the line of the orbit. The peculiar position of the teeth gives the side of the face, when the mandible is closed, a horizontally extended concavity.

The dentition is remarkable for its complexity, and for the difference in character presented by the superior and inferior series. Leidy pointed out the character of the latter[1] in the *Hadrosaurus foulkei*, and I have described the character of the superior dentition in the genera Cionodon[2] and Diclonius[3]

As compared with the *Hadrosaurus foulkei*, the dental magazine is much deeper, and contains a greater number of teeth in a vertical column, and probably a larger number in the aggregate. I find in each maxillary bone of the *Diclonius mirabilis*, six hundred and thirty teeth, and in each splenial bone, four hundred and six teeth. The total number is then two thousand and seventy-two.

The greater part of the external and inferior faces of the ramus of the lower jaw is formed by the surangular bone, which has an enormous extent, far exceeding in size that of any known reptile. It extends posteriorly to below the quadrate cotylus. Anteriorly it spreads laterally and unites with its fellow of the opposite side, forming a short symphysis and simulating a dentary. In correspondence with this extent of the surangular, the splenial is enormously developed, and contains the great magazine of teeth which I have described as characteristic of this type.[4] Its internal wall is very thin, and adheres closely to the faces of the teeth, in the fossil, in its present condition. This development and dentition of the splenial bone distinguishes the Hadrosauridæ widely from the Iguanodontidæ. The dentary bone is a flat, semicircular plate attached by a suture to the extremities of the surangulars. There is no trace of symphysial suture, and the posterior border sends a median prolongation backwards, which is embraced by the surangulars. The edge of the dentary is flat, thin and edentulous, and closes within the edge of the premaxillary.

Dermal or corneous structures have left distinct traces in the soft sandstone about the end of the beak-like muzzle. Laminæ of brown remnants of organic structures were exposed in re-

[1] Cretaceous Reptiles North America, 1864, p. 83.

[2] Vertebrata of Cretaceous formations of the West, 1875, p. 59.

[3] Proceedings Philadelphia Academy, 1876, p. 250.

[4] Bulletin Geological Survey of the Territories. F. V. Hayden, III, pp. 594–7, May, 1877.

moving the matrix. One of these extends as a broad vertical band round the sides, indicating a vertical rim to the lower jaw, like that which surrounds some tea trays, and which probably represents the tomia of the horny sheath of a bird's beak. At the front of the muzzle its face is sharply undulate, presenting the appearance of vertical columns with tooth-like apices. Corresponding tooth-like processes, of much smaller size, alternate with them from the upper jaw. These probably are the remains of a serration of the extremital part on the horny tomia, such as exist on the lateral portions in the lamellirostral birds.

General affinities.—The structure of the skull of this species adds some confirmation to the hypothesis of the avian affinities of the Dinosauria, which I first announced, as indicated by the hind limbs, and which Professor Huxley soon after observed in the characters of the limbs and pelvis. The confirmation is, however, empirical rather than essential, and is confined to a few points. One of these is the form and position of the vomer, which much resembles that seen in lamellirostral birds. The large development of the premaxillary bone has a similar significance. So has the toothless character of that bone and the dentary.

Among reptiles this skull combines, in an interesting way, the characters of the two orders Crocodilia and Lacertilia. The extension of the premaxillary above the maxillary, so far as to overlap the lachrymal, is unique among Vertebrata, so far as I am aware. The free exoccipito-intercalare hook is scarcely less remarkable.

Of mammalian affinity no trace can be found.

Restoration.—This animal in life presented the kangaroo-like proportions ascribed by Leidy to the *Hadrosaurus foulkei.* The anterior limbs are small, and were doubtless used occasionally for support, and rarely for prehension. This is to be supposed from the fact that the ungual phalanges of the manus are hoof-like, and not claw-like, though less ungulate in their character than those of the posterior foot. The inferior presentation of the occipital condyle shows that the head was borne on the summit of a vertical neck, and at right angles to it, in the manner of a bird. The head would be poised at right angles to the neck when the animal rested on the anterior feet by the aid of a U-like flexure of the cervical vertebræ. The general appearance of the head must have been much like that of a bird.

The nature of the beak and the dentition indicate, for this strange animal, a diet of soft vegetable matter. It could not have eaten the branches of trees, since any pressure sufficient for their comminution would have probably broken the slightly attached teeth of the lower jaw from their places, and have scattered them on the floor of the mouth. It is difficult to understand also how such a weak spatulate beak could have collected or have broken off boughs of trees. By the aid of its dentate horny edge it may

have scraped leaves from the ends of branches, but the appearances indicate softer and less tenacious food. Could we suppose that the waters of the great Laramie lakes had supplied abundant aquatic plants without woody tissue, we would have the condition appropriate to this curious structure. Nymphæas, Nuphars, Potamogetons, Anacharis, Myriophyllum, and similar growths, could have been easily gathered by this double spoon-like bill, and have been tossed, by bird-like jerks of the head and neck, back to the mill of small and delicate teeth. In order to submit the food to the action of these vertical shears, the jaws must have been opened widely enough to permit their edges to clear each other, and a good deal of wide gaping must, therefore, have accompanied the act of mastication. This would be easy, as the mouth opens, as in reptiles and birds generally, to a point behind the line of the position of the eye. The eye was evidently of large size. The coronoid process of the mandible encroaches on the orbit below, and the temporal muscle evidently did so posteriorly. It is probable, as suggested to me by Mr. Geismar, that in the act of mastication the eye was alternately protruded and retracted with the contraction and extension of the temporal muscle. The indications are that the external ear was of very small size. There is a large tract that might have been devoted to the sense of smell, but whether it was so or not is not easily ascertained.

We can suppose that the long hind legs of this genus and of Hadrosaurus were especially useful in wading in the waters that produced their food. As Dollo has shown that the muscles of the fourth trochanter (third trochanter Auctorum) are attached to the proximal caudal vertebræ, one can see the huge tail swing from side to side with each advancing step, and create a great swirl in the water. When the bottom was not too soft, they could wade to a depth of ten or more feet, and, if necessary, drag aquatic plants from their hold below. Fishes might have been available as food when not too large, and not covered with bony scales. Most of the fishes of the Laramie period are, however, of the latter kind (genus Clastes). The occurrence of several beds of lignite in the formation shows that vegetation was abundant.

EXPLANATION OF PLATES.

(All are natural size.)

PLATE XVI. Side view of the skull of *Diclonius mirabilis*.

" XVII. The same viewed from above.

" XVIII. Inferior view of the same.

" XIX, Fig. 1. View of occipital region of the same. Fig. 2. View of the extremity of the muzzle from the front.

The complete iconography of this species will appear in the Report of the United States Geological Survey, under J. W. Powell, now in course of preparation.

—*E. D. Cope.*

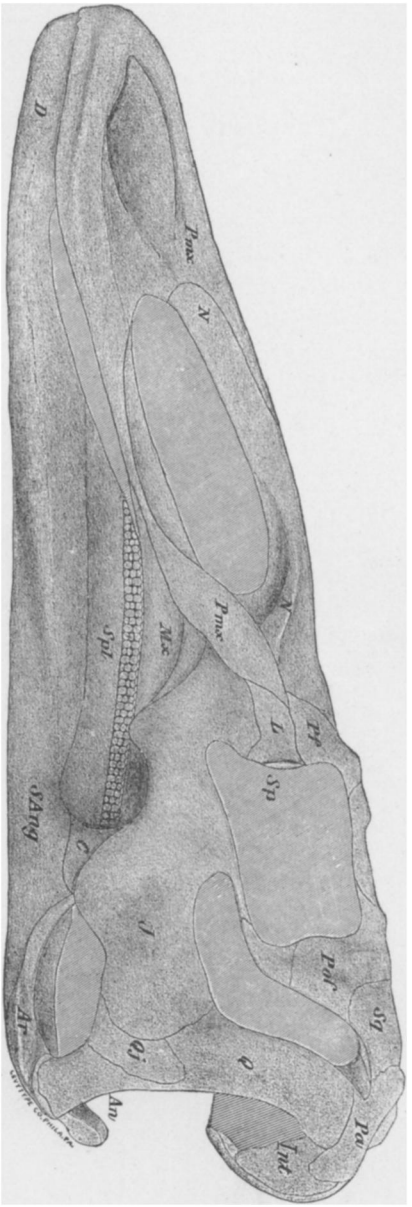
A NEW EDENTATE.—M. Burmeister describes, under the name of *Nothropus priscus*, a sloth from the pampas of the Argentine Republic. Megatherium, Scelidotherium, Mylodon, and other gigantic related forms did not climb trees, and were not nearly related to the existing Bradypodidæ, whereas Nothropus, though twice the size of the largest sloth now living, probably possessed their arboreal habits. Though half the lower jaw with three teeth is all that is known of this genus, the form of the bone and conformation of the teeth is unmistakable, but approaches Cholœpus more than Bradypus. The crown of the hinder molars has a tendency to divide into two lobes, thus recalling the molars of the huge extinct gravigrades.

GEOLOGICAL NEWS. — *Palæozoic.* — In the May issue of the *Geological Magazine*, Professor C. Lapworth commences a series of articles upon the stratigraphy of the highly convoluted lower Palæozoic rocks, with the object of showing that conclusions as to the relative age of the strata, based upon their apparent position, may often prove erroneous through the abrupt sigmoidal flexures that complicate their structure. After denudation has taken place, an older stratum of the upper part of the sigmaplex or sigmoidal fold may apparently rest unconformably upon a newer stratum.

Tertiary.—Baron von Ettingshausen contributes to the April issue of the *Geological Magazine* an article upon the Tertiary flora of Australia, including a list of about a hundred species. Twenty-seven species from Dalton, New South Wales, are all new, but only two of the twenty-one genera are new, the others occurring in the Tertiary of Europe (19), North America and North Asia (13), Java (4), Sumatra (3). Only six are contained in the living flora of Australia. Thus the Tertiary flora of Australia is far more nearly allied to the Tertiary floras of the other continents than to the living flora of Australia.——Mr. E. T. Newton has published the results of his investigations among the Vertebrata of the Forest Bed series of Norfolk and Suffolk. Exclusive of some unnamed Cervidæ, seventy-nine species are enumerated, including the mammoth. Three species are entirely new. These remains belong to the fauna of Great Britain in the period immediately antecedent to the Glacial epoch.

Quaternary.—The fauna and flora of the European loess are again brought to the front by Mr. Howorth in an answer (*Geol. Mag.*, May) to Dr. Nehring. Mr. Howorth maintains that the "steppe fauna" of the latter is rather an upland fauna, and that the grassy regions which, according to Dr. Nehring, existed and supplied pasturage for this fauna, could not possibly be the source of the accumulations of dust needed by Dr. Richthofen's theory of the origin of the loess.——The Philosophical Faculty of the University of Munich have awarded the prize offered for a "Thorough description of the Diluvial Glacial formations and

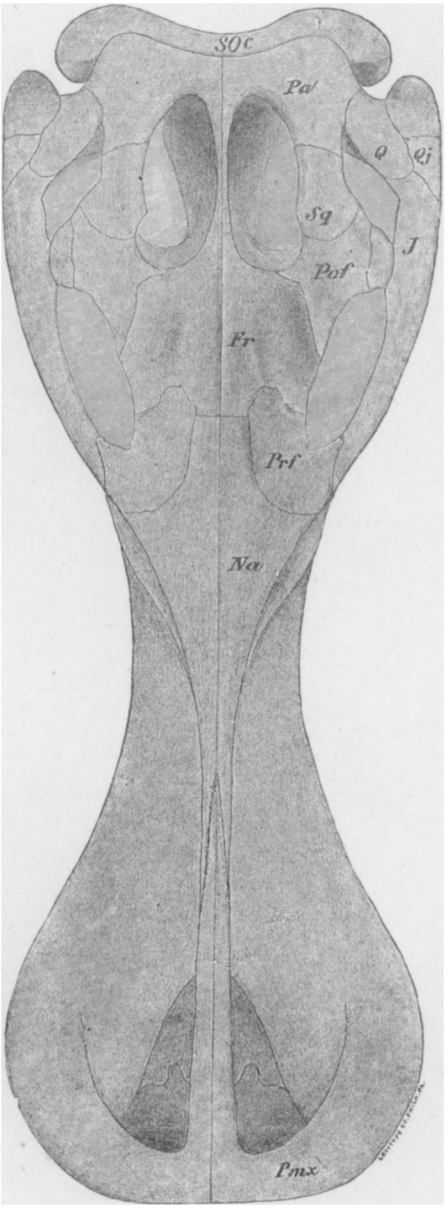
PLATE XVI.



Diclonius mirabilis, one-seventh nat. size.

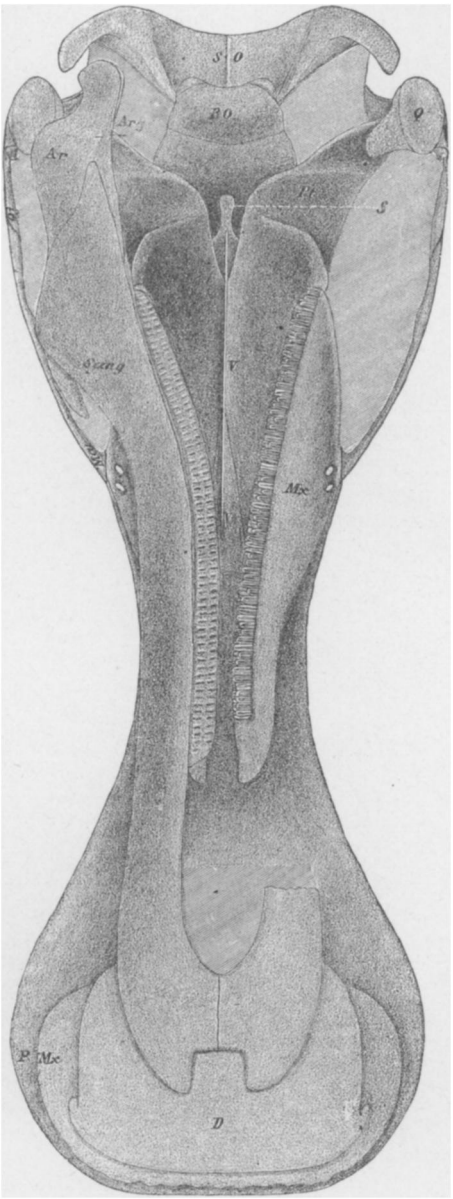
NOTE ON DICLONIUS.—The plates of the skull of the *D. mirabilis*, issued with this number of the NATURALIST, should be bound with the preceding (July) number. The statement in the latter, "All the figures are of the natural size," is of course erroneous. The space for proportion of size was left to be filled, and was closed and printed inadvertently.

PLATE XVII.



Diclonius mirabilis, one seventh nat. size.

PLATE XVIII.



Diclonius mirabilis, one-seventh nat. size.

PLATE XIX.

Diclonius mirabilis, one-seventh nat. size; posterior and anterior extremities of skull.

phenomena in the region of the South Bavarian high plateau, and also in the Bavarian Alps," to Dr. A. Penck, of the Munich University. The work treats of the last glaciation of Upper Bavaria and North Tyrol, of older glaciations in the same districts, and of the formation of the Upper Bavarian lakes. A complete description of the effects of ice action in the defined localities, is given, also a comparison with those of North Germany and Scandinavia, and the concluding chapter has an able discussion on the causes of the Glacial epoch.——At a recent meeting of the Geological Society of London, Mr. D. Mackintosh gave the results of observations on the positions of boulders relatively to the ground around and below them. His investigations were carried on near Llangollen (Wales) and at Clapham (Yorkshire) and his results are, that the average *vertical extent* of the denudation of limestone rock around boulders has not been more than six inches, and that this denudation has been at a rate of not less than an inch in a thousand years. This gives not more than 6000 years since the boulders were deposited.

Recent.—The Rev. A. Irving (*Geological Magazine*, April) gives the classification of landslips adopted by Herr Heini, of Zurich. These "Bergstürze" are either "Schuttrutschungen" or descents of water-logged accumulations from the mountain slope into the valley, a movement which sometimes produces striations simulating those of glacial action; "Schuttstürze," or emptyings upon the valley below of loose material, accumulated in a minor valley on the mountain side; Felsschlipfe," or loosenings of the upper strata, when the general dip is towards the valley, by the erosion of the lower part of the sides into a slope much deeper than the dip slope of the strata of the mountain above; and "Felsstürze," or the breaking loose from the sides of the mountain of huge masses of rock.

MINERALOGY.[1]

Scovillite, a new mineral.—Professors G. J. Brush and S. L. Penfield have described[2] an interesting mineral from the Scoville ore bed in Salisbury, Conn., which occurs as an incrustation on certain iron and manganese ores. The incrustation, one-sixteenth of an inch or less in thickness is sometimes botryoidal or stalactitic in form and in cross fracture has a radiated, fibrous structure. It thus resembles in its mode of occurrence similar coatings of gibbsite. It has a pinkish, brownish, or yellowish-white color, a silky to vitreous lustre on the fracture, but has a greasy look on the natural surfaces, resembling some varieties of chalcedony or smithsonite. Hardness=3. 5. Specific gravity 3.94–4.01.

[1] Edited by Professor H. Carvill Lewis, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

[2] *Amer. Journ. Sc. and Arts*, June, 1883.